

Measuring Treasury Debt and Market Depth

Dr. Andrew Keinsley

Weber State University

November, 2023

- US fiscal debt has come back into sharp focus recently
 - COVID-19
 - Industrial policy
 - Inflation
 - Rising interest rates
- Traditional view of the UST market focuses on size, not depth
- Contributions
 - ① Simple sum of USTs is incorrect
 - ② Derivation of user cost of USTs
 - ③ Creation of index to track true aggregate
 - ④ Value of USTs directly impacts fiscal sustainability

USTs are Imperfect Substitutes

Literature

- Krishnamurthy and Vissing-Jorgensen (2012, 2013)
- Nagel (2016)
- ⋮
- All: the various maturities/types of UTSs have different attributes/purposes

Findings

- Extension of Amihud and Mendelson (1991)
 - Match securities that mature within one day of each other
 - Regress YTM spreads against a variety of factors
- **Contribution**
 - Bills are a liquidity hedge
 - Bonds are a savings vehicle
 - They should not be linearly aggregated

The User Cost of Treasury Securities

- A proper index number
 - Not the aggregate, itself
 - Tracks the aggregate nonparametrically
 - Must be derived from optimization

- Standard single-period user cost

$$\eta_t = \frac{R_t - r_t}{1 + R_t}$$

- Barnett (1978)
- Opportunity cost of holding the asset

- Partial equilibrium model: household
 - Standard utility maximization
 - Short- and long-term bonds, and a benchmark asset

- **Contribution**

- Deriving the single-period user cost of a long-term asset

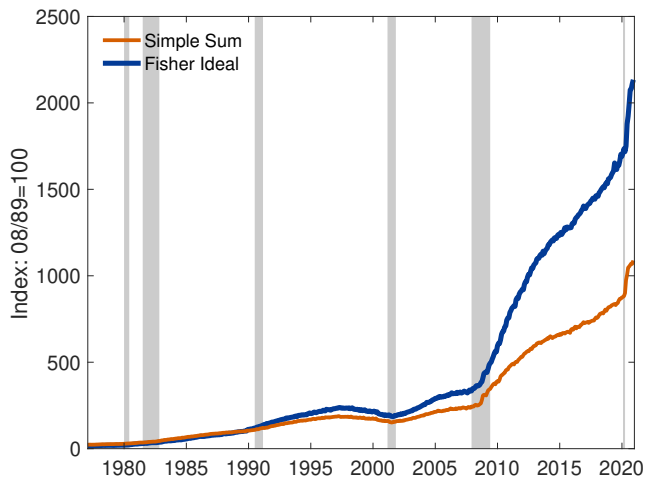
The User Cost of Long-Term Treasury Securities

$$\eta_t^L = \frac{\mathbb{E}_t \left[\frac{\mu_{t+1}}{\mu_t} \frac{1}{\pi_{t+1}} \left\{ \overset{\text{one-period return, benchmark}}{\downarrow} R_t^n - (1 - \delta) \gamma_{3,t+1} \Delta R_{t+1}^n - \left(\overset{\text{long-term bond}}{\downarrow} r_t^{L,n} - (1 - \alpha) \gamma_{4,t+1} \Delta r_{t+1}^{L,n} \right) \right\} \right]}{\mathbb{E}_t \left[\frac{\mu_{t+1}}{\mu_t} \frac{1}{\pi_{t+1}} \left\{ 1 + R_t^n - (1 - \delta) \gamma_{3,t+1} \Delta R_{t+1}^n \right\} \right]}$$

- $R_t^n, r_t^{L,n}$ are “coupon” rates
 - $\gamma_{i,t+1}$ is the expected price
 - $\delta, \alpha \in (0, 1]$ are the maturity rates
- $\left. \begin{array}{l} \text{ } \end{array} \right\} \gamma_{3,t+1} \Delta R_{t+1}^n$ is the expected capital gain

Data and Baseline Result

- Center for Research in Securities Pricing (CRSP)
- CUSIP-level, monthly data on US Treasuries: 1977-2020
- 1-month ahead forward rates used for expected values
- Fisher-ideal index functional form
 - Securities separated by type
 - Then separated by quarters to maturity

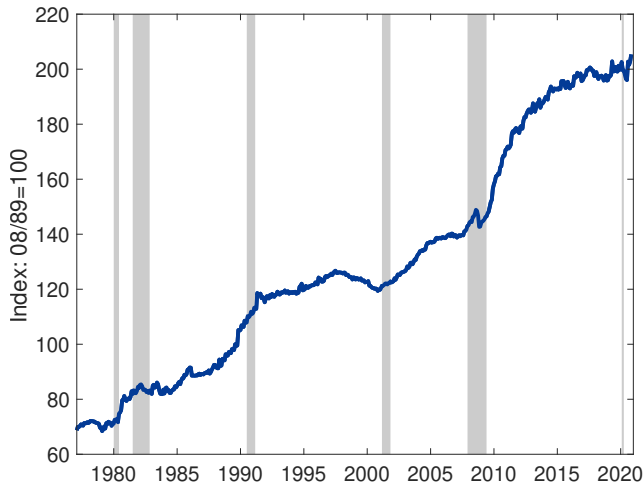


Extracting the Monetary Services of Treasury Securities

$\% \Delta(\text{Quantity} + \text{Monetary Services})$

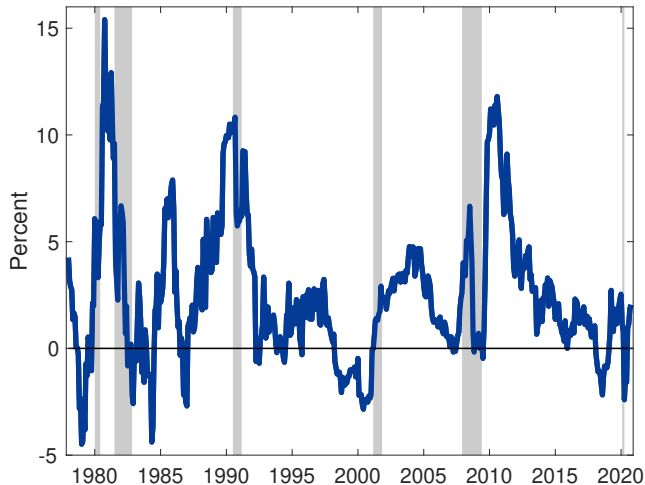
$-\% \Delta(\text{Quantity})$

$= \% \Delta(\text{Monetary Services})$



It's all Relative

- This index is a measure of the “depth” of the market
- More recent movements align with
 - Budget surpluses of the 1990s
 - European debt crisis of the 2010s
 - COVID-19 “dash for cash”



The Value of Treasury Securities

- Traditional accounting of fiscal capacity relies on the simple sum of USTs
- The analysis here shows that this is incorrect
- USTs provide a monetary service to the economy
- Brunnermeier, Merkel and Sannikov (2022)-like analysis
- **Contribution**
 - The value of USTs directly contributes to fiscal sustainability
 - Also see the tradeoffs faced when considering a portfolio of USTs with varying maturities

Fiscal Capacity and the Value of USTs

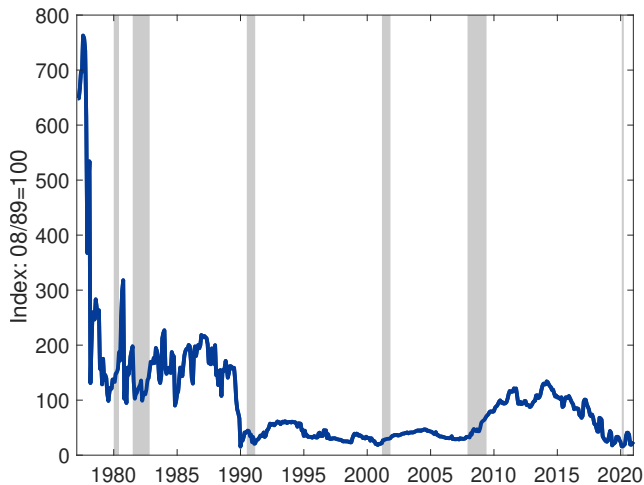
$$\begin{aligned}
 \frac{B_{t-1} + B_{t-1}^L}{p_t}(1 + r_{t-1}) = & \underbrace{s_t}_{\text{Primary surplus}} - \underbrace{(r_{t-1}^L - r_{t-1}) \frac{B_{t-1}^L}{p_t}}_{\text{Spread Component}} + \beta \mathbb{E}_t \left[\frac{\mu_{1,t+1}}{\mu_{1,t}} \frac{B_t + B_t^L}{p_{t+1}} (1 + r_t) \right] \\
 & + \beta \mathbb{E}_t \left[\frac{\mu_{1,t+1}}{\mu_{1,t}} \frac{B_t^L}{p_{t+1}} (1 + r_t^L - (1 - \alpha) \gamma_{4,t+1} \Delta r_{t+1}^{L,n} - r_t) \right] + \gamma_{2,t} \frac{M_t}{p_t}
 \end{aligned}$$

↑
Relative Holding-Period Return
↑
Value of Monetary Services

- M_t is stock of monetary services
- $\gamma_{2,t}$ is the price dual of those monetary services
- Thus, the value of these monetary services directly adds to fiscal capacity

The Value of these Monetary Services

- Price dual via Fisher's factor reversal
- Further exploration of this is needed
 - Fiscal sustainability
 - Inflation
 - Monetary policy



	Notes–Bills	Bonds–Notes	Bonds–Bills
Relative Bid-Ask Spread	0.4163** (0.173)	0.0981 (0.074)	−0.1424** (0.074)
Coupon Rate Spread	0.0210*** (0.001)	0.0170*** (0.005)	0.0076 (0.013)
10y-2y Spread	0.0234*** (0.003)	−0.0124*** (0.002)	−0.0484 (0.033)
⋮	⋮	⋮	⋮
Observations	2250	7430	78
R-Squared	0.207	0.505	0.399
F-statistic	99.48	207.2	20.19